

WHAT IS CLAIMED IS:

1. An apparatus for monitoring the concentration of an oxidative gas or vapor, the apparatus comprising:

a chemical substance which reacts with the oxidative gas or vapor to produce a heat change; and

a temperature probe coupled to the chemical substance, wherein the temperature probe is adapted to respond to the heat change.

2. The apparatus as defined in Claim 1, wherein the oxidative gas or vapor comprises hydrogen peroxide.

3. The apparatus as defined in Claim 1, wherein the chemical substance is a material that catalytically decompose hydrogen peroxide.

4. The apparatus as defined in Claim 1, wherein the chemical substance is a material that is oxidized by hydrogen peroxide.

5. The apparatus as defined in Claim 1, wherein the chemical substance comprises hydroxyl functional groups.

6. The apparatus as defined in Claim 1, wherein the chemical substance is a material selected from the group consisting of catalase, copper and copper alloys, iron, silver, platinum, and platinum on alumina.

7. The apparatus as defined in Claim 1, wherein the chemical substance is a material selected from the group consisting of magnesium chloride ( $MgCl_2$ ), iron (II) acetate, potassium iodide (KI), sodium thiosulfate, molybdenum disulfide, 1,2-ethanedithiol, methyl disulfide, cysteine, methionine, and polysulfides.

8. The apparatus as defined in Claim 1, wherein the chemical substance comprises a polymer comprising hydroxyl functional groups, the polymer being selected from the group consisting of polyethylene glycol (PEG), polyethylene oxide (PEO), and polyvinyl alcohol (PVA).

9. The apparatus as defined in Claim 1, additionally comprising a carrier which couples the chemical substance to the temperature probe.

10. The apparatus as defined in Claim 9, wherein the carrier comprises acrylic, epoxy, nylon, polyurethane, polyhydroxyethylmethacrylate (polyHEMA),

polymethylmethacrylate (PMMA), polyvinylpyrrolidone (PVP), polyvinylalcohol (PVA), silicone, tape, or vacuum grease.

11. The apparatus as defined in Claim 9, wherein the carrier comprises a gas-permeable pouch or gas-impermeable enclosure with at least one hole.

5 12. The apparatus as defined in Claim 11, wherein the gas-permeable pouch comprises a nonwoven polyolefin material.

13. The apparatus as defined in Claim 1, wherein the apparatus further comprising a heat conductor between the chemical substance and the temperature probe.

10 14. The apparatus as defined in Claim 1, wherein the temperature probe further comprising a connector to connect and disconnect the portion of the temperature probe coupled to the chemical substance to the remaining portion of the temperature probe.

15 15. The apparatus as defined in Claim 1, wherein the temperature probe is movable and capable of measuring the temperature at a particular location, and producing an output signal which is a function of the temperature.

16. The apparatus as defined in Claim 1, wherein the temperature probe is a fiberoptic temperature probe, fluoroptic temperature probe, thermocouple probe, thermistor, glass thermometer, RTD probe, temperature strip, optical temperature sensor, or infrared temperature sensor.

20 17. The apparatus as defined in Claim 1, further comprising a reference temperature probe adapted to measure temperature fluctuations not due to the concentration of the oxidative gas or vapor.

18. The apparatus as defined in Claim 17, wherein the reference temperature probe is in proximity to the temperature probe.

25 19. The apparatus as defined in Claim 17, wherein the reference temperature probe is substantially identical to the temperature probe but does not comprise the chemical substance.

20. A method of monitoring the concentration of an oxidative gas or vapor, the method comprising:

30 providing a chemical substance which undergoes a reaction with the oxidative gas or vapor to be monitored, thereby producing a heat change;

providing a temperature probe coupled to the chemical substance, the temperature probe adapted to respond to the heat change produced by the reaction between the chemical substance and the oxidative gas or vapor to be monitored by producing an output signal which is a function of the concentration of the oxidative gas or vapor;

exposing the chemical substance to the oxidative gas or vapor;

measuring the output signal from the temperature probe; and

determining the concentration of the oxidative gas or vapor based on the output signal.

21. The method as defined in Claim 20, wherein the oxidative gas or vapor comprises hydrogen peroxide.

22. The method as defined in Claim 20, wherein the chemical substance is a material that catalytically decomposes hydrogen peroxide.

23. The method as defined in Claim 20, wherein the chemical substance is a material that is oxidized by hydrogen peroxide.

24. The method as defined in Claim 20, wherein the chemical substance comprises hydroxyl functional groups.

25. The method as defined in Claim 20, wherein the chemical substance is a material selected from the group consisting of catalase, copper and copper alloys, iron, silver, platinum, and platinum on alumina.

26. The method as defined in Claim 20, wherein the chemical substance is a material selected from the group consisting of magnesium chloride ( $MgCl_2$ ), iron (II) acetate, potassium iodide (KI), sodium thiosulfate, molybdenum disulfide, 1,2-ethanedithiol, methyl disulfide, cysteine, methionine, and polysulfides.

27. The method as defined in Claim 20, wherein the chemical substance comprises a polymer comprising hydroxyl functional groups, the polymer being selected from the group consisting of polyethylene glycol (PEG), polyethylene oxide (PEO), and polyvinyl alcohol (PVA).

28. The method as defined in Claim 20, wherein the temperature probe is coupled to the chemical substance by a carrier comprising acrylic, epoxy, nylon, polyurethane, polyhydroxyethylenemethacrylate (polyHEMA), polymethylmethacrylate

(PMMA), polyvinylpyrrolidone (PVP), polyvinylalcohol (PVA), silicone, tape, or vacuum grease.

29. The method as defined in Claim 20, wherein the temperature probe is coupled to the chemical substance by a carrier comprising a gas-permeable pouch or gas-impermeable enclosure with at least one hole.  
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30. The method as defined in Claim 20, additionally comprising moving the temperature probe to a particular location, and producing an output signal which is a function of the temperature at that location.

31. The method as defined in Claim 20, additionally comprising:

10 providing a reference temperature probe which detects temperature fluctuations not due to the concentration of the oxidative gas or vapor and which produces a reference output signal which is a function of the temperature fluctuations;

15 measuring the reference output signal from the reference temperature probe; and

utilizing the reference output signal to compensate for the temperature fluctuations not due to the concentration of the oxidative gas or vapor.

32. A sterilization system operated by a user, wherein the sterilization system comprises:

20 a chamber;

a door in the chamber;

a source of oxidative gas or vapor in fluid connection with the chamber;

a chemical concentration measuring system comprising at least one apparatus according to Claim 1; and

25 a control system which receives input from the chemical concentration measuring system to produce a desired concentration of said oxidative gas or vapor.

33. The system as defined in Claim 32, wherein the system further comprises a pumping system to reduce the pressure in the chamber.

30 34. The system as defined in Claim 32, wherein the oxidative gas or vapor comprises hydrogen peroxide.

35. The system as defined in Claim 32, further comprising a reference temperature probe adapted to measure temperature fluctuations not due to the concentration of the oxidative gas or vapor.